An outline for the proposed research work submitted to the

"An Approach for Micro-Watershed Level Development and Management using Geoinformatics Techniques for Warasgaon Lake Catchment of Pune District (MS)"

Swami Ramanand Teerth Marathwada University, Nanded

Under the Faculty of Humanities

In the Subject of Geography

For the award of

Doctor of Philosophy

Submitted By

Swati S. Kalwade

M.A., M.Phil.

Under the Guidance of

Dr. Narendra G. Mali

M.A, M.Ed, Ph.D.

Head and Research Supervisor

Department of Geography

Mahatma Basweshwar College, Latur – 413 512.

Research Centre

Mahatma Basweshwar College, Latur

December 2017

"An Approach for Micro-Watershed Level Development and Management using Geoinformatics Techniques for Warasgaon Lake Catchment of Pune District (MS)"

Introduction

Land resource forms the most important wealth of any region. Its proper utilization and management is a matter of utmost concern to the people. Improper use of land has created so many problems like land degradation, wastage and decline in productivity. Therefore, optimum utilization and strategic management of land resources, according to its capability in a planned manner is essential.

Soil is the earth's fragile skin that anchors all life on Earth. It is comprised of countless species that create a dynamic and complex ecosystem and is among the most precious resources to humans. Geomorphological factors such as slope, drainage pattern, soil type, tri etc. affect the soil erosion process.

Soil erosion is one of the most serious environmental problems in the world today and with decreased soil fertility causes the destruction of our natural ecosystems like pastures, forests and agricultural ecosystems and also caused siltation problem in of warasgaon lake catchment. It's also reduced the capacity of storage of water in the dam. Soil erosion (land degradation) is an important social and economic problem and an essential factor in assessing ecosystem health and function. It is a process of deterioration of the fertile soils and loss of biological and economic productivity in different forms that leads to a situation of unbalanced environmental conditions. Soil erosion is a fundamental and complex natural process that depends mainly on rainfall erosivity, soil erodibility, land cover and topography and is strongly modified (generally increased) by human activities such as land clearance, agriculture (ploughing, irrigation, grazing), forestry, construction, surface mining and urbanization.

The study area of warasgaon lake catchment region is very vulnerable to soil erosion due to its undulating topography, steep slopes and high rainfall. The alarming rate of soil erosion in this region having land degradation at higher level calls for urgent attention to this problem.

The main factors affecting the amount of soil erosion and land degradation include vegetation cover, topography, soil, and climate. In order to

describe the areas with high soil erosion risks and to develop adequate erosion prevention measures in the watersheds of dams, erosion risk maps should be generated considering these factors. Remote Sensing (RS) and Geographic Information System (GIS) technologies were used for erosion risk mapping in Warasgaon lake catchment.

The general research aim was to estimate the effect of soil erosion on soil loss per year with the help of recent Geoinformatics technique. To reach this goal the following objectives had to be satisfied: computation of rainfall-runoff erosivity factor (R); computation of cover management factor (C); examination of the spatial distribution of slope factors (LS) in terms of their erosion status; and characterization of the major soil types and computation of soil erodibility factor (K).

Accelerated erosion is due to manmade activities which have brought about changes natural cover and soil condition. These activities include land preparation for raising crops, land use patterns for building houses infrastructure, industries, hill cutting, deforestation, lack of soil conservation and watershed management.

The amount of soil erosion is mainly affected by vegetation cover, topographic features, climatic variables, and soil characteristics. The human activities and large-scale developments alter the vegetation cover, impacting upon the soil erosion rate. Topographic features such as ground slope, slope length, and shape most affect rill and interrill erosion. The most important climatic variables are rainfall amount and precipitation intensity, which are called rainfall erosivity. Besides, temperature is another important climatic variable since it affects the vegetative materials which are used in mulching to control erosion. Soil erodibility is mainly affected by aggregate stability, texture, depth, organic matter, and stoniness.

Assessing the soil erosion rate is essential for the development of adequate erosion prevention measures for sustainable management of land and water resources. Geographic Information System (GIS) technologies are valuable tools in developing environmental models through their advance features of data storage, management, analysis, and display. The Remote Sensing (RS) technology has been used to provide the land use/cover information by using

digital image processing techniques. There have been many studies on modeling soil erosion by utilizing RS and GIS technologies.

RS and GIS integrated techniques do not only estimate soil loss but also provide the spatial distributions of the erosion. Especially, generating accurate erosion risk maps in GIS environment is very important to locate the areas with high erosion risks and to develop adequate erosion prevention techniques. Conducted a study where RS and GIS technologies were successfully used for land degradation and erosion mapping.

Soil erosion evaluation and mapping of soil loss susceptible area also helps to understand soil conservation and ecosystem system management mechanisms in the watershed.

This research has given answers to four core research questions; how much of soil is lost per unit area of land annually in warasgaon lake catchment
And where are erosion hotspot areas located for conservation prioritization? It was also supportive to evaluate the effectiveness of soil and water conservation measures implemented so far in the WLC. (Warasgaon lake catchment)

Choice of the Study Area

The area of the proposed study is the Warasgaon Lake Catchment located in the Western flanks of Sahyadri in Pune district of Maharashrta State of the western Ghat and occupies its position in upper Bhima Basin.

The study area comprises medium size watershed namely Warasgaon also known as Veer Bajee Pasalkar Reservoir. The study area lies between the geocordinates 18^0 21' 00" to 18^0 25'48" North latitude and 73^0 25'12'' to 73^0 37' 12" East Longitude. Warasgaon reservoir constructed on Mose River which is a major tributary of Mutha River. It is 40 K.m from west of Pune City near Warasgaon. Total catchment area is 132.64 sq.k.m. The total Gross storage of dam is 374.00 M.cu. The live storage is 364.00 M.cum and dead storage is 10.00 M.cu. The flood discharge is 1416 cusecs. The reduced level from Riverbed is 579.43 m. The total length of dam is 780 m. This dam is a typical Masonry Type.

The altitude varies between 600 mtr–1080 mtr above MSL the Warasgaon Backwater Lake is about 18 k.m in length on the river Mose.

Average annual rainfall range between 1000–1200 mm, with average temperature 32^0. The area is enjoying subtropical monsoon with moderately

warm to hot summer, high monsoon rains and of cold winter season, that's why the region has reflected 50% is covered with forest of varying density with tropical evergreen, Tropical semi-evergreen and tropical moist deciduous forest. The terrain consists of low-lying valley to highly dissected ridges farming ridge valley topography.

The areas comprises of 23 villages, with having 3000 and around population. People are poor and backward. They don't have communication facilities and infrastructure development.

Aims and Objectives of the Study

The objectives of the present study are focused on to delineate a watershed characteristics & its analysis for the watershed. This analysis and support system takes the form of a computer model developed in a Geographic Information Systems (GIS) framework, specifically the Arc/Info and Arc View platforms developed by ESRI. The study objectives are-

1 To understand the several factors responsible for Land degradation (soil erosion), through various techniques of GIS (Geographic Information System) and delineate the different sub watersheds.

2 To study the properties of soil and LU/LC analysis for reckoning on the latest utilization of land resources in the study area.

3 To ascertain find of degraded lands of the study areas in terms of various land facets susceptible to severe soil loss.

4 To delineate the Priority areas based on erosion prone areas and to suggest measures for conservation and suggesting measures for management purpose.

5 Preparation of thematic maps Using Various GIS software's.

Database and Methodology

In order to fulfill the objectives outlined above, the methodology will be adopted on the following lines and can be separated in two components:

I) Field Component:

This will consist of field survey.

a) To carry out GPS survey of Study area.

b) Taking the Soil samples to infer the soil properties, then infiltration measurement to determine the infiltration capacity of the area.

c) To do the groundtruthing for filed check (Change detection).

II) Laboratory Component:

a) Base map preparation will be done using toposheet nos. 47 F/ 11 & 7 covering the study area.

b) High resolution RS data of the entire catchment will be procured from NRSC as well as from Landsat data for delineation of watershed.

c) Digitization of various layers will be performed using GIS software's to build a geodatabase in GIS Environment

d) Various thematic maps will be prepared to through GIS software's like Arc GIS & Erdas Imagine, Global mapper and QGIS.

e) Morphometric analysis & terrain analysis.

f) To find out major causes of, soil loss estimation and runoff estimation. The mapping and data base will be prepared according to input parameters of these equations.

g) In order to develop a prioritization for study area the entire area will be classified into micro watersheds along with its database. And firing the query in GIS environment.

Hypothesis

1. "Land resource assessment can help in planning and management of watershed at micro level.
2. Advance technique like GIS and Remote sensing, litho-climatic and manmade factors reduce severity of soil erosion & land degradation and intern improve sustainability of watershed".

Review of Literature

The review of literature is focused to current situation of research .It also states the present study and gives the information regarding the past background of study, and the past, present and recent developments in the subject status of research in that field. For the present study, various studies on the similar work and other work have been reviewed. Some of the scholars and their research work are mentioned below.

1. Guang -Te Wang,shulin chen." In his study he focused on -A linear spatially distributed model for a surface rainfall- runoff system 1995, pp-183-197.

2. Xiaoyong Zhan, Min-LangHuang- He used GIS techniques for runoff estimation. “Arc CN – Runoff: an Arc GIS tool for generating curve number and runoff maps 2004, pp- 875-878.
3. B.Von Wesemael, J.Poesen, A.Sole Benet, L.Cara Barrionuevo and J. Puigdefabregas.” Collection and storage of runoff from hillslope in a semi-arid environment: geomorphic and hydrologic aspects of the aljibe system in Almeria Province, Spain 1998, pp, 1-12.
4. Lei Wang, Dr. Dennis Truax, Gaurav Savant (Mississippi State University),Remote Sensing and Geospatial Applications for Watershed , pp-2-4.
5. Roy C. Sidle, Yuichi Onda (2004) “ Hydrogeomorphology: overview of an emerging science. Pp-597-600.
6. Binay kumar ,Uday Kumar(2011): Micro watershed characterization an prioritization using Geomatics techonology for natural resource management(International journal of Geomatics and geosciences vol 1, No 4 page no. 1)
7. Sarita Gajbhiye, S.K. Sharma and Chandrashekhar Meshram (2014):Prioritization of watershed through sediment Yield Index using RS and GIS approach International journal of u and e service, science and technology(vol-7 page no 1-2)
8. M.L.Waikhar and Aditya P. Nilawar (Jan/Feb 2014) vol 2 . Morphometric analysis of a drainage basin uaing Geographical Information System: A case study
9. Ashis pandey, P.P Dabral,V.M Chaw dary, B.C. Mal, “Estimation of runoff for agricultural watershed using SCS curve number and geographic information system.
10. A.A Kulkarni,S.P. Aggarwal, K.K.Das. “Rainfall Runoff modeling of Warasgaon Dam catchment – a geospatial approach.
11. Vinaya V.Kashid, Dissertation 2005-06.”Estimation of surface runoff using SCS-CN method – a study of basin near shirkoli village, tahsil velhe, district Pune.
12. Savindra Singh (1998) ‘Geomorphology’, prayag pustak bhavan, Allahabad.

13. Roy C. Sidle, Yuichi Onda (2004) “Hydrogeomorphology: overview of an emerging science. Pp-597-600.
14. Takashi Gomi, Roy C. Sidle and Douglas N. Swanston-(2004) “Hydrogeomorphic linkages of sediment transport in headwater streams, Mybeso Experimental Forest sougheast Alaska. Pp—667-682.
15. T.A Endreny, E.F. Wood and D.P.Lettenmaiex (2000), “Satellite derived digital elevation model accuracy: hydrogeomorphological analysis requirements.
16. Maharashtra government: PWD Hand book ‘Siltation in dam site’.

Tentative Chapter Scheme

The present work would be tentatively outlined in the following manner

Present research work has been divided into seven chapters.

Chapter first: The first chapter deals with the introduction about research topic and particularly outlines major approaches of the study, statement of problem, need for soil and land degradation information soil resource management, significance of the study, It also discusses aims and objectives. Hypothesis has been put forth regarding the present study, research methodology and approach, purpose of the study social relevance of the study and arrangement of the text.

Chapter second: This chapter is outlined by the study area and methodology having geographical setup and aims and objectives. Methodology of the study and database is also outlined.

Chapter third: This chapter gives the detail analysis of relief and terrain characteristics of the study area with the help of Geoinformatics techniques.

Chapter four: This chapter deals with soil properties (, physical and chemical) of the study area, including soil survey and soil analysis, thematic maps of soil prepared by GIS techniques and interpretation of maps.

Chapter five: This chapter mainly based on the assessment of Land Degradation Index (LDI) for Warasgaon lake catchment based on estimation of soil loss and terrain analysis. USLE is used for soil loss. This part of study is mainly based on Remotesensing and GIS technique.

Chapter six: This chapter focuses to prioritized the area in suitable sub- basin to forms the base for the management plan of the study area

Chapter seven: This chapter summarizes discussion, Major finding, suggestion and conclusion of the research work of the study area.

Date:

Place: Latur.

Research Fellow
Swati S. Kalwade

Research Supervisor
Dr. Narendra G. Mali
Head and Research Supervisor
Department of Geography
Mahatma Basweshwar College,
Latur – 413512.